Time Budgeting In The Say's Phoebe (*Sayornis saya*) and the Western Kingbird (*Tyrannus verticalis*)

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INTRODUCTION

A major component of a species' fitness is its ability to utilize time effectively. Through the process of natural selection a species becomes efficient at organizing its activities to suit habitat, temperature, competition, and the availability of food. In an area such as the Harney Basin, where temperatures may rise and fall 45°F in a 24 hour period, time budgeting is especially important. A bird must organize its time so as to minimize water and energy loss maintaining body temperature, yet still be efficient when feeding.

To exemplify this time budgeting two species were studied- the Say's Phoebe (Sayornis saya) and the Western Kingbird (Tyrannus verticalis). Two general questions were considered:

1) What effect does time of day have on the patterns of activity and habitat utilization of these two species, and
2) What effect does caring for nestlings have on the activity patterns of two very similar species.

METHODS AND MATERIALS

This study was conducted over a two week period from July 15 to July 28, 1972, on the Malheur National Wildlife Refuge. All data was collected by following a particular bird as closely as possible and recording its behavior and position every 15 seconds. Correct time intervals were maintained by using an electronic metronome connected to an earphone, which gave a signal every 15 seconds. Observations were only recorded exactly on the signal. Behavior and position between these signals was not recorded. By using this frequency sampling technique one could tell what percentage of a bird's time was spent in any particular activity or position.

The day was divided into five 3 hour intervals; 5:30 - 8:30 a.m., 8:30 - 11:30 a.m., 11:30 - 2:30 p.m., 2:30 - 5:30 p.m., and 5:30 - 8:30 p.m. Both species were observed for a 45 minute period during each of these intervals, resulting in 180 observations per period.

Bird activity was put under one of six classifications (Table 1):

1) Aggression - The bird was exhibiting agonistic behavior toward another bird or animal.

2) Perching -

3) Preening -

4) Flying - The bird was in the air, but not chasing prey.

5) Hawking, air - The bird was chasing prey in the air. Probably many reports classified as 'flying' fit into this category, but unless definite hawking motions were observed the activity was classified 'flying'.

6) Hawking, ground - The bird was chasing prey that was on the ground.

The bird's position was put under one of seven classifications (Table 2):

1) Wire - Perching on any wire over six feet high.

2) Fence - Perching on any wire or post more than one foot and less than six feet off ground.

3) Ground - Perching on anything less than one foot high or on ground.

4) Low structure - Perching on any house or building.

5) Low foliage - Perching on any bush, plant, or tree less than six feet high.

6) Tree - Perching on any plant over six feet high.

7) Nesting area - This category was used because the observed Say's Phoebe was nesting out of site in a storage shed. It was assumed that when the bird flew into the shed (the floor of the shed was visible through a door) it was perching on or near the nest, which was constructed on a ceiling beam.

8) In air - This category contains all instances of bird either flying, Hawking-air, Hawking-ground, or showing aggressive behavior (which was always done in the air).

Any time a bird changed positions between metranome signals it was recorded, 180 position changes during a 45 minute period being the maximum possible. This data was used as an indicator of the general activity of the bird (Table 3).

The habitat of the nesting Say's Phoebe pair was the station trailer court.

Their nest was located in a trailer storage shed along the southern perimeter of the court. The same pair of Phoebes were observed throughout the period and, whenever possible, the same bird was observed. Due to lack of sexual dimorphism it was difficult to be sure one was observing the same bird all the time, especially when both would disappear into the nesting area together.

The habitat of the trailer court consists primarily of sagebrush, some green grass, approximately 10 trailers, 12 sheds, several fences, and telephone wires. There are no trees in the area, and the only available water is in a puddle usually found under a water faucet. Other birds noted in this habitat were Robins (Turdus migratorius), Brewer's Blackbirds (Euphagus cyanocephalus), English Sparrows (Passer domesticus), and Common Nighthawks (Chordeiles minor).

The Say's Phoebes were always observed near their nest, usually perched on a wire or low structure in the trailer court. The Phoebe very seldom went more than 150 feet from its nest, and then only for short periods.

The Western Kingbird was more difficult to observe in any one habitat. The main location used was a farm at the head of the Cole Island Dike, but the bird was not always present there. It ranged between the farm and the Refuge Headquarters area, and since approximately 5-6 birds were in the area, one could not be sure that he was always watching the same bird. The Kingbirds were not nesting, and this too made identifying the same bird difficult. The ranch at the head of the Cole Island Dike is surrounded by a habitat of sagebrush and contains one large deciduous tree surrounded by a green, well watered lawn. Western Kingbirds were observed here and in an area of sagebrush between the ranch and the refuge headquarters. The Kingbirds were usually observed on wires near the ranch house, in the large tree, or on fences or wires in the sagebrush area. Other birds observed in this habitat were Bank Swallows (Riparia riparia), Common Nighthawks (Chordeiles minor), Brewer's Blackbird's (Euphagus cyanocephalus), Sage Sparrows (Amphispiza belli), and two Sparrow Hawks (Falco columbarius).

RESULTS

The general activity for both birds, as reflected by changes of position (table 1), dropped considerably for the period 8:30-11:30 a.m. and rose sharply for the

period 2:30-5:30 p.m. The Say's Phoebe's activity level dropped from the 11:30-2:30 p.m. period to the 5:30-8:30 p.m. period, and the Western Kingbird's activity level rose from the 2:30-5:30 p.m. period to the 5:30-8:30 p.m. period. The Phoebe was most active in the early morning; the Kingbird was most active during the evening. The Phoebe flew more and perched less in the early morning, while the Kingbird flew more and perched less in the late evening (Table 3).

The general activity level of the Phoebe was generally higher throughout the day than that of the Kingbird, yet both birds had a very similar rate of both perching and flying (Table 4). The Phoebe also spent less time preening than did the Kingbird.

Both species preferred perching on fences and in low foliage during periods of high activity, and perching on telephone wires during periods of low activity (Table 2&3), yet the Phoebe hawked on the ground and Kingbird did not. The Kingbird exhibited more agonistic behavior than did the Phoebe.

DISCUSSION

The Phoebe had its heaviest activity and feeding period in the early morning; the Kingbird had its greatest activity in the late evening. Yet both species were observed feeding on similar insects in similar habitats. A possible explanation of this phenomenon is that the Phoebe is gathering food for its young, and they have just gone through seven hours without food. The Phoebe has to make up for this foodless period by feeding itself and its young heavily in the morning. The Kingbird has only itself to feed so it can maintain a lower rate of feeding, peaking out at the end of the day to hold energy levels through the night.

Another possible reason is that the Phoebe is strictly a resident of hot dry areas such as the Harney Basin, but the Kingbird, with a broader distribution, sometimes frequents greener areas such as the Willamette valley (Bent, 1942). The Kingbird's time budget was probably based on the fact that it has evolved as a more elastic species, and because it was not raising young.

A reason for the drop in feeding activity for both species during the period

8:30-11:30 a.m. could be due to a lack of insects during this period, although no verifying data are available. Another reason for the Phoebes drop in activity could be that it was satiated by a period of heavy feeding, or that it needed a period of rest after a period of such high activity.

The Kingbird preened more than the Phoebe, and its physical appearance was much better. This is probably because the Kingbird was just finishing its post-nuptial molt, and the Phoebe was just starting its molt. A probable explanation for both species' choice of the fence as a favorite perching spot during feeding is that the fence is closer to available food. Insects are in the highest concentrations near to the ground, the fence is the nearest perching spot to these concentrations, so both birds will naturally sit on fences while feeding.

The reason that both birds sit on telephone wires during periods of low activity is probably merely that the air is cooler higher up than down near the ground. By perching in the cooler spot the birds are making maximum use of the habitat to minimize energy and water loss.

SUMMARY

1) A study was conducted at the Malheur National Wildlife Refuge on the time budgeting of the Say's Phoebe and the Western Kingbird.

2) Both species were followed over a 15 hour period, and observations were recorded every 15 seconds for five 45 minute periods on each species.

3) The results of the study were:

   a) The Phoebe was most active in the morning; the Kingbird was most active in the evening.

   b) The general activity of the Phoebe was higher.

   c) Activity for both species dropped sharply for the period 8:30-11:30 a.m.

   d) The Kingbird preened more than the Phoebe.

   e) Both species preferred to perch on fences during high activity levels, and on telephone wires during periods of low activity.

4) Some conclusions reached to explain the differences in time budgeting between the two species were:

a) The Phoebe was nesting and is a species found only in habitat such as the Harney Basin.

b) The Kingbird was through nesting and is a more elastic species, found in several different types of habitat.

BIBLIOGRAPHY

Bent, Arthur Cleveland. 1942. Life Histories of North American Flycatchers, Larks, Swallows, and their Allies. U.S. Nat. Mus. Bull. 179. 553 pp.

TABLE 1 : General Activity of Phoebe and Kingbird by Number of Position Changes per Time Period.

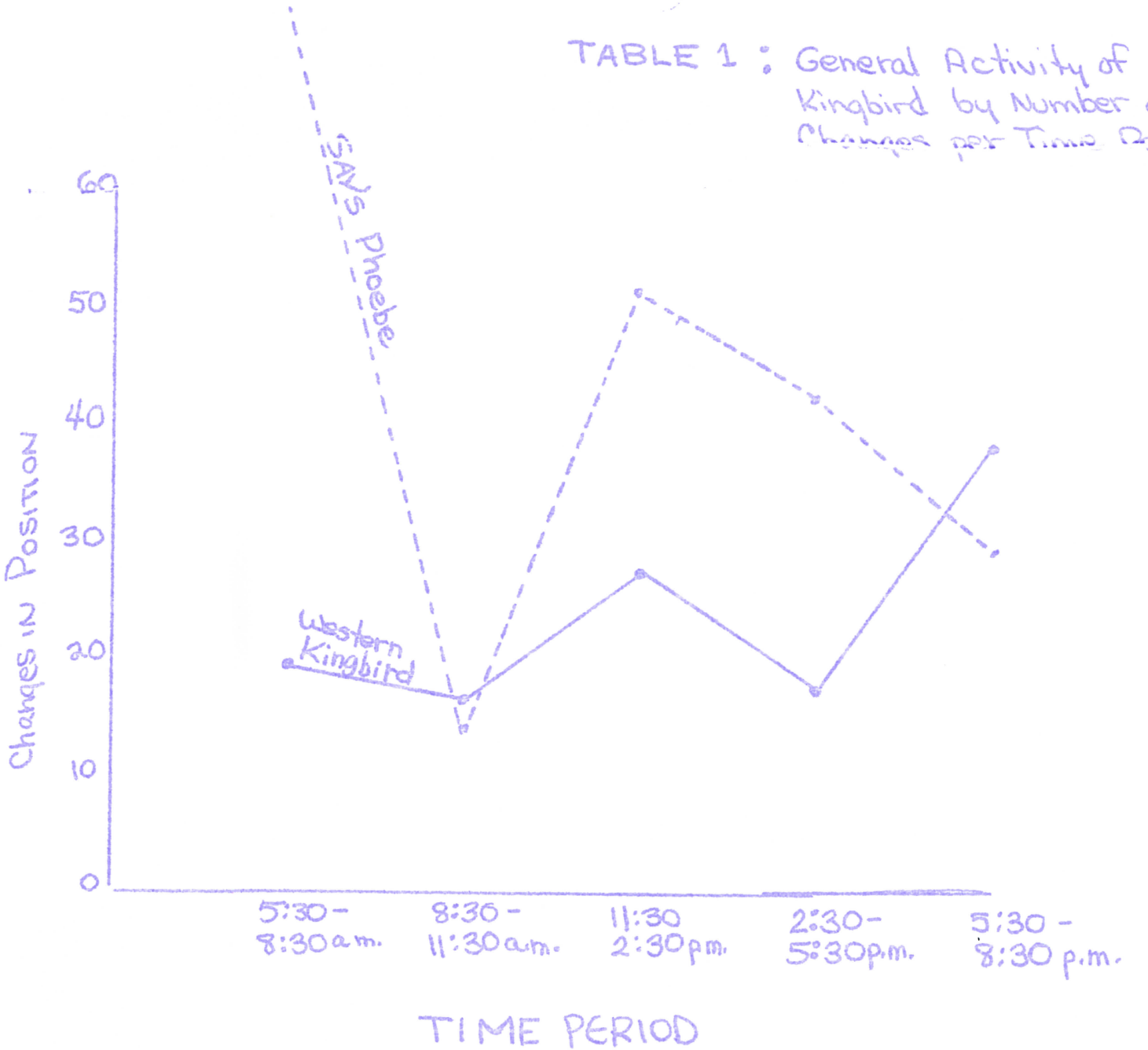

Table : Time Utilization (of position) by Number of Incidents per Time Period.

		TIME PERIOD				
Western Kingbird		5:30-8:30a.m.	8:30-11:30a.m.	11:30-2:30p.m.	2:30-5:30p.m.	5:30-8:30p.m.
POSITION	Fence	9	18	151	138	173
	Wire	163	108	0	0	43
	Low foliage	0	2	8	28	4
	Tree	0	27	0	0	17
	Ground	1	0	4	0	5
	Low structure	0	8	0	0	0
	In air	7	7	17	14	35
Say's Phoebe						
POSITION	Fence	43	16	48	33	8
	Wire	37	87	57	18	69
	Low Foliage	5	0	0	1	0
	Nest area	10	5	16	16	3
	Ground	7	3	27	69	69
	Low Structure	43	50	14	28	11
	In air	35	19	18	15	20

Table 2: Time Utilization (of activity) by Number of Incidents per Time Period.

	5:30-8:30a.m.	8:30-11:30a.m.	11:30-2:30p.m.	2:30-5:30p.m.	5:30-8:30p.m.	Total for Day	Percent of Total	Type of Activity
Western Kingbird	19	16	27	17	38	117	13.0%	Changes of Position
Say's Phoebe	86	14	51	42	29	222	24.7%	
Western Kingbird	173	173	163	166	145	820	91.1%	Perching
Say's Phoebe	145	161	162	165	160	793	88.1%	
Western Kingbird	5	2	0	19	0	26	2.1%	Preening
Say's Phoebe	0	0	2	6	0	8	.9%	
Western Kingbird	4	3	11	11	25	54	6.0%	
Say's Phoebe	20	9	16	8	16	69	7.7%	Flying
Western Kingbird	2	0	4	3	4	13	1.4%	
Say's Phoebe	10	6	2	4	4	26	2.1%	Hawking-air
Western Kingbird	0	0	2	0	0	0	.0%	
Say's Phoebe	2	4	0	3	0	9	1.0%	Hawking-ground
Western Kingbird	1	4	0	0	6	11	1.2%	Aggressive behavior
Say's Phoebe	3	0	0	0	0	3	.3%	

TABLE 4 : Time Utilization (activity) by Percent for Total Period